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PLUG-IN-UNIT
LA-265-L

INSTRUCTIONS AND PARTS BREAKDOWN

Lavoie Laboratories, Inc.
MORGANVILLE, NEW JERSEY

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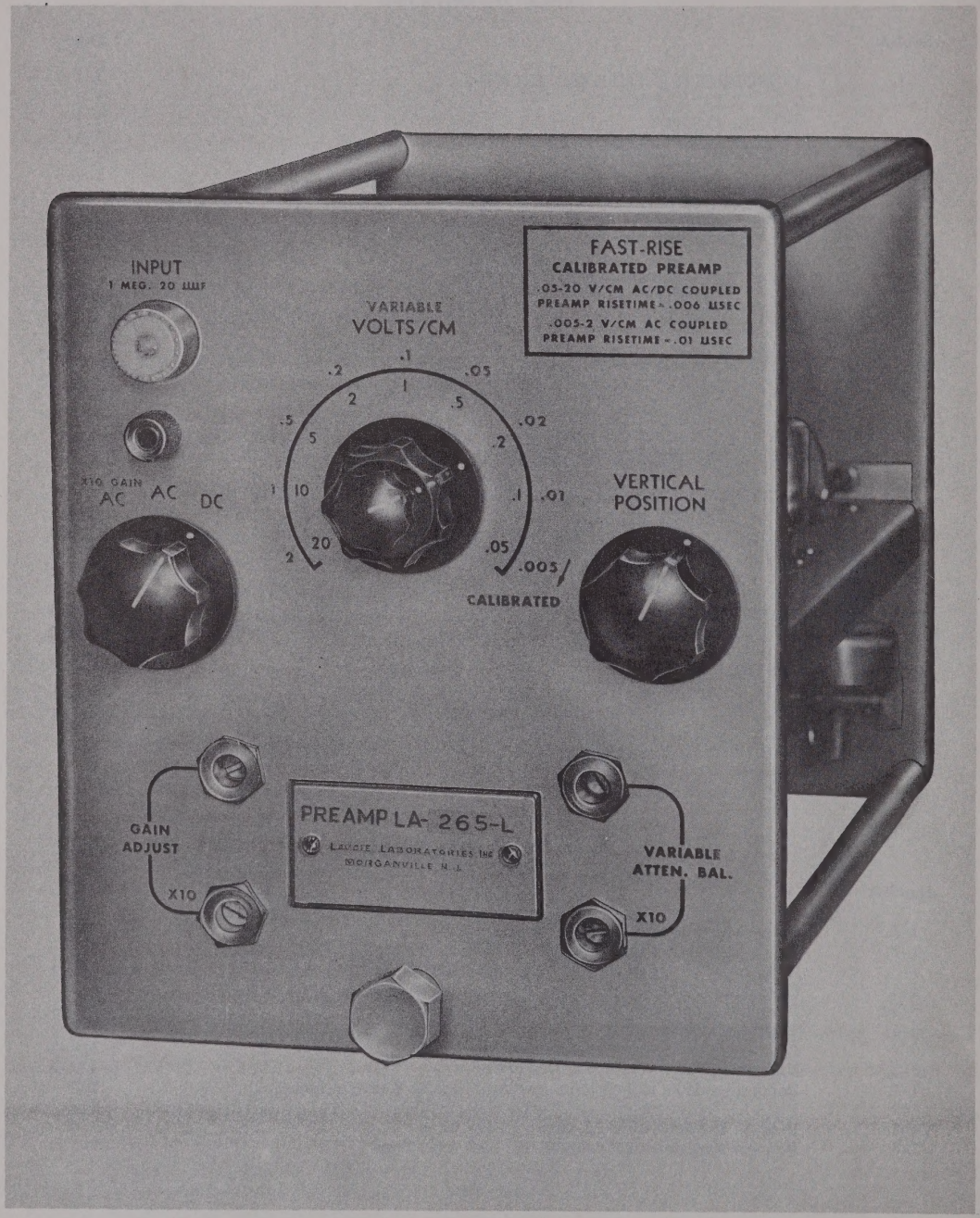

Figure 1-1. Plug-in Preamplifier, LA-265-L

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. INTRODUCTION.

1-2. This technical manual presents operation and service instructions for the Plug-in Preamplifier, Lavoie Part Number LA-265-L (hereafter referred to as the preamplifier). The preamplifier is manufactured by Lavoie Laboratories, Inc., Morganville, New Jersey (see figure 1-1).

1-3. PURPOSE.

1-4. The preamplifier is a fast rise, high gain calibrated preamplifier for use with Oscilloscopes LA-265, LA-275, LA-275C, LA-285 and other compatible oscilloscopes.

1-5. LEADING PARTICULARS.

1-6. Figure 1-2 lists the leading physical and electrical characteristics of the preamplifier when operated with the oscilloscopes listed, or equivalent.

1-7. PHYSICAL DESCRIPTION.

1-8. The preamplifier flush mounts into the front panel of oscilloscope and is secured in place with a thumbscrew. A connector at the rear of the preamplifier mates with one in the oscilloscope to provide electrical interconnection. Four operating controls and four calibrating controls are accessible at the front panel of the preamplifier.

1-9. PRINCIPLES OF OPERATION. (See figure 1-3.)

1-10. GENERAL. The preamplifier is a fast-rise, high-gain, calibrated plug-in preamplifier, comprised of two stages of amplification, and several stages of cathode followers.

1-11. SIGNAL INPUT. The signal from the INPUT connector on the front panel is applied to the grid of the input cathode follower tube, V5832, through contacts of the AC-DC-ACX10 switch SW5002A. When

	LA-265 LA-285	LA-275 LA-275C
Risetime (when used with Oscilloscopes listed or equivalent)	15 Nsec	13 Nsec
Bandpass (when used with oscilloscopes listed or equivalent)		
DC	DC to 30 MC	DC to 40 MC
AC	2 CPS to 30 MC	2 CPS to 40 MC
AC X 10	3 CPS to 24 MC	3 CPS to 27 MC
Vertical Deflection Sensitivity		
AC or DC input	0.05 volts/cm to 20 volts/cm, in nine calibrated steps. 0.05 volts/cm to 40 volts/cm, variable.	
AC X 10 input	0.005 volts/cm to 2 volts/cm, in nine calibrated steps. 0.005 volts/cm to 5 volts/cm, variable.	
Input Characteristics		
Without Probe	1 megohm shunted by 20 uuf.	
With Probe	10 megohms shunted by 8 uuf.	
Peak Input Voltage	600 volts; combined dc and peak ac input.	
Unit Weight	Approximately four pounds.	
Unit Size	11-3/4 x 5-7/8 x 7 inches	

Figure 1-2. Table of Leading Particulars

the AC or ACX10 input is selected, capacitor C5002, functioning as a dc blocking capacitor, is switched into the input circuit.

1-12. The VOLTS/CM switch, SW5052A, inserts frequency compensated attenuator networks into the input circuit. The nine calibrated attenuators provide voltage attenuation ratios of 1X, 2X, 4X, 10X, 20X, 40X, 100X, 200X, and 400X, corresponding to deflection sensitivities of 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, and 20 volts per centimeter respectively. The variable input capacitor in each of the frequency compensated attenuators, (except the 1X attenuator) provides a means of adjusting the input capacity to a standard value of 20 micro-microfarads. Capacitor C5732 compensates the 1X network, thus insuring that the input capacitance for all settings of the VOLTS/CM switch is the same.

1-13. INPUT CATHODE FOLLOWER. The input cathode follower tube, V5832, performs two functions. By isolating the input circuit, it prevents component aging in the preamplifier or main amplifier from affecting the apparent input characteristics. Secondly, tube V5832, by isolating the circuit, prevents changes in the input circuit, from affecting operation of the preamplifier or main amplifier. When the AC or DC position of switch SW5002B is selected, pin 6 of V5832 is connected through resistor R5812 to the plus 100 volt supply, which is electronically regulated, thus insuring proper dc and low frequency operation. When the ACX10 position of switch SW5002B is selected, the screen grid voltage for tube V5832 is obtained from the decoupling network consisting of resistor R5802 and capacitor C5802. This network decouples any slight voltage fluctuations present in the power supply from the sensitive preamplifier input circuits.

1-14. ACX10 PREAMPLIFIER. The ACX10 mode of operation utilizes two amplifiers and one cathode follower stage consisting of tubes V5942, V6042, and V6132, and provides a calibrated signal gain of ten. Switch SW5002C, when in the ACX10 position, couples the cathode of tube V5832 to the grid of first amplifier tube V5942. The output signal from tube V5942 is fed to the second amplifier tube, V6042, and then to the ACX10 cathode follower, tube V6132. The gain of the amplifier stages is controlled by the setting of the X10 GAIN ADJ potentiometer, R6052. Potentiometer R6052 determines the gain by varying the degeneration in the cathode circuit of tube V6042. For calibrated operation, the control is set for a gain of ten.

1-15. Three variable inductors and one fixed inductor (peaking coils) provide a means of obtaining optimum high frequency response for the amplifiers. Peaking coils L5942 and L6012 are connected in a series-shunt configuration, and L5902 and L6112 as series peaking coils. The high capacitance values of capacitors C6002A and C6002B in the plate circuits of tubes V5942 and V6042 respectively, overcome the low frequency attenuation introduced by the interelectrode capacitance of the tube elements, and the rc coupling between stages. The Cathode Current Adj, potentiometer R5922 is provided to ensure operation of tube V6042 on a particular portion of its characteristic curve. R5922 is adjusted to obtain the proper grid voltage for tube V6042; indicated by a voltage drop of 55 volts across cathode resistor R6072. Potentiometer R6242 permits adjustment of tube V6132 cathode voltage to the same amplitude as the cathode voltage from tube V5832. Diode CR5972 in the cathode circuit of tube V5942 protects the electrolytic cathode bypass capacitor, C5972, from being de-polarized should the cathode voltage go highly negative due to the failure of the tube V5942. The output signal of the ACX10 cathode follower, tube V6132, is fed through switch SW5002D to the input of the phase inverter stage which consist of tubes V6242 and V6342.

1-16. PHASE INVERTER STAGE. The phase inverter stage, consisting of tubes V6242 and V6342 in a cathode-coupled configuration, converts a single ended input into a push-pull output. The VARIABLE operating control, potentiometer R6352, between the phase inverter cathodes, controls the gain of the stage over a 2 to 1 range by varying the amount of degeneration in the cathode circuits. GAIN ADJ potentiometer R6392 is a front panel screwdriver adjustment for calibrating the stage gain to correspond with the panel markings. This procedure is performed with the VARIABLE control at the CALIBRATED (maximum gain) position. To prevent a vertical shift of the beam position when the VARIABLE control is rotated, VARIABLE ATTEN. BAL. potentiometer R6812 is provided. Adjustment of R6812 varies the grid voltage on tube V6342, thus varying the cathode voltages, of the phase inverter tubes. When the cathode voltages are equal, vertical shift of the beam position, when the VARIABLE control is rotated, is prevented.

1-17. The front panel VERTICAL POSITION operating control, R6522, and the screwdriver adjustment, Vert. Pos. Range, potentiometer R6572, provide vertical positioning of the beam. These are dual controls, each being connected between plus 225 volts dc and ground. They are physically ganged, so that electrically, when the voltage in one leg increases, the voltage in the other decreases. When the voltage in one leg is different from the voltage at the plate of the corresponding tube, current flows through the associated limiting resistor (R6512 or R6532 for the VERTICAL POSITION control), and the associated plate load resistor (R6292 and R6302) resulting in a plate voltage change. Because the following stages, tubes V6732A and V6732B are direct coupled, any plate voltage change in tubes V6242 and V6342 is displayed as a vertical movement of the beam on the cathode ray tube (crt). The resultant outputs of tubes V6242 and V6342 are two signals 180 degress out of phase, the relative dc levels of which are determined by the VERTICAL POSITION control.

1-18. OUTPUT CATHODE FOLLOWERS. Two stages of cathode followers are fed by the phase inverter stage. The first cathode follower stage, consisting of both halves of tube V6732, prevent capacitive loading of the plate circuits of the phase inverter stage. The second cathode follower stage, consisting of both halves of tube V6632, provides a low impedance match

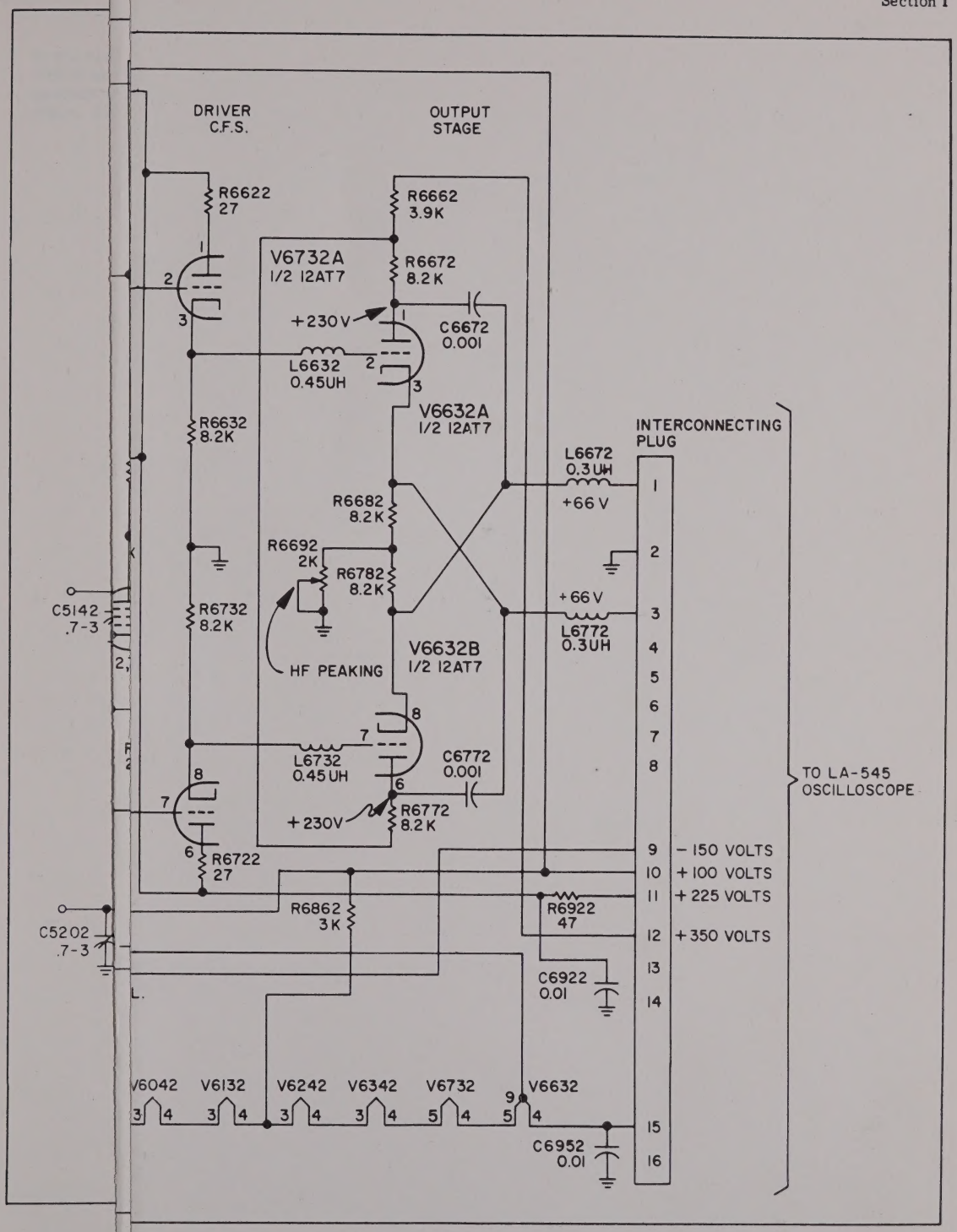

Figure 1-3. Plug-In Preamplifier LA-265-L, Schematic Diagram

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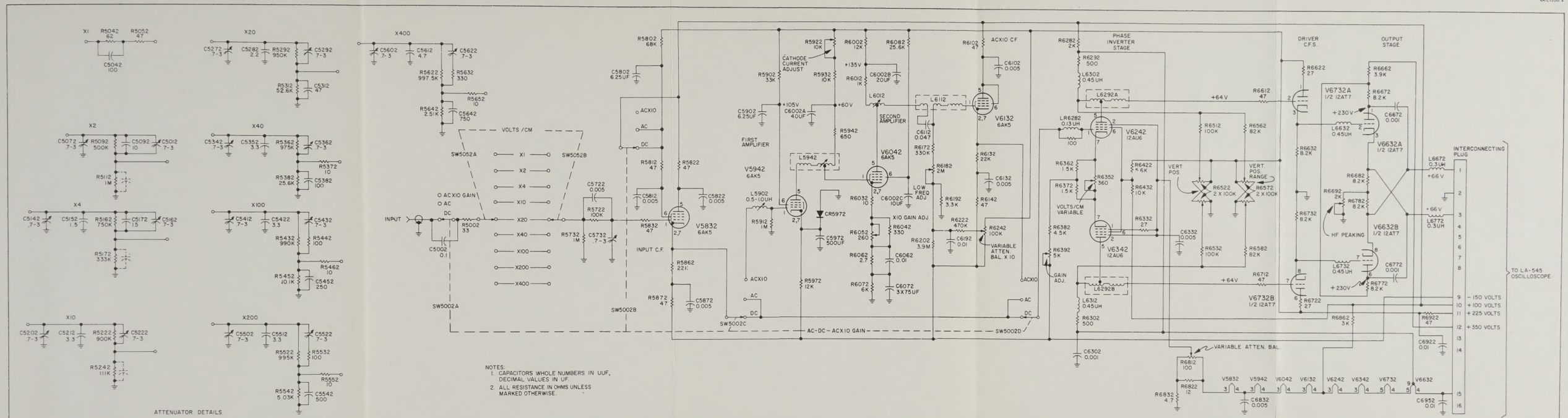

NOTES:
1. CAPACITORS WHOLE NUMBERS IN UUF, DECIMAL VALUES IN UF.
2. ALL RESISTANCE IN OHMS UNLESS MARKED OTHERWISE.

Figure 1-3. Plug-In Preamplifier LA-265-L, Schematic Diagram

to the oscilloscope input circuits. Plate resistors R6671 and R6772, and capacitors C6672 and C6772 provide high frequency balance of the final output stage. The HF Peaking potentiometer R6692, in the cathode of tube V6632, effectively changes the impedance of the cathode circuits, thus controlling the operation of high frequency peaking coils L6672 and L6772 in the output lines.

SECTION II

SPECIAL SERVICE TOOLS

2-1. INTRODUCTION.

2-2. Special tools are not required to operate or maintain the preamplifier.

2-3. Figure 7-1 lists standard test equipment utilized during maintenance of the preamplifier. The standard test equipment listed in figure 7-1 may be replaced or supplemented by equipment of equivalent capabilities.

SECTION III

PREPARATION FOR USE OR STORAGE

3-1. PREPARATION FOR USE.

3-2. Remove the preamplifier from the shipping container using care to avoid denting, scratching or marring the surface of the equipment. Visually inspect the preamplifier as follows:
a. Check the front panel controls, connectors, and engraving for ease of operation, security, and cleanliness, as applicable.
b. Check all parts for broken wires, abraded insulation, and general condition.

3-3. Upon ascertaining that the preamplifier has not been damaged during shipment, secure it to the oscilloscope front panel. Guide the plug-in preamplifier into the front panel, until it bottoms. Press the preamplifier firmly into the mating connector and secure it in place with the thumbscrew at the bottom of the preamplifier.

3-4. STORAGE.

3-5. For short term storage intervals, the preamplifier may be placed into its shipping container, or on padding in a cabinet in a weather protected area where it will not be subjected to rough handling. Storage for long intervals requires that bagged desiccant, Specification MIL-D-3464, be placed inside the shipping container. Fungus treatment shall be performed in accordance with Specification MIL-T-152, to the extent required by local climate conditions.

SECTION IV

OPERATION INSTRUCTIONS

4-1. PRELIMINARY ADJUSTMENTS.

4-2. There are two adjustments that must be made prior to operating the preamplifier for the first time, and periodically thereafter. These adjustments, the gain adjustment and variable attenuator balance, must be checked periodically to compensate for tube and circuit aging, or errors may result in obtaining vertical amplitude measurements. The two adjustments are described in paragraphs 4-3 and 4-4.

4-3. VARIABLE ATTENUATOR BALANCE ADJUSTMENT. If the trace on the oscilloscope shifts vertically as the VARIABLE control is rotated, the VARIABLE ATTEN. BAL. adjustments shall be made as follows:
a. Apply power to the preamplifier by setting oscilloscope POWER ON switch at the ON position.
b. Set the preamplifier controls as follows:

VOLTS/CM	0.5 (black numbers)
VARIABLE	CALIBRATED
AC-DC-ACX10 GAIN	AC
AMPLITUDE CALIBRATOR (Oscilloscope)	.2 VOLTS

c. Adjust the oscilloscope controls for a free running trace, place the AC-DC-ACX10 GAIN control at the AC position.
d. Rotate the VARIABLE control back and forth, and

simultaneously adjust the preamplifier front panel upper VARIABLE ATTEN. BAL. potentiometer until no noticeable trace shift is apparent.

e. Set the AC-DC-ACX10 GAIN control at the ACX10 GAIN position. Repeat step d, adjusting the lower X10 VARIABLE ATTEN. BAL. potentiometer.

4-4. GAIN ADJUSTMENT. Proceed as follows:

a. Set controls as indicated in paragraph 4-3 b.

b. Connect the test lead (supplied with oscilloscope) between the oscilloscope CAL. OUT connector, and the preamplifier INPUT connector.

c. Adjust the oscilloscope controls for a stable display of the square-wave calibrator signal.

d. Using a screwdriver, adjust the preamplifier front panel upper GAIN ADJUST potentiometer for a vertical deflection of four major graticule divisions.

e. Set the preamplifier controls as follows:

VOLTS/CM	.005 (blue numbers)
VARIABLE	CALIBRATED
AC-DC-ACX10 GAIN	ACX10GAIN
AMPLITUDE CALIBRATOR (Oscilloscope)	20 MILLIVOLTS

f. Adjust the oscilloscope controls for a stable display of several cycles of the square-wave calibrator signal.

g. Using a screwdriver, adjust the preamplifier front panel lower X10 GAIN ADJUST potentiometer for a vertical deflection four major graticule divisions.

4-5. OPERATING CONTROLS.

4-6. The purpose and use of controls utilized during operation of the preamplifier are described in figure 4-1.

4-7. OBTAINING VOLTAGE MEASUREMENTS.

4-8. GENERAL. Because the preamplifier is a plug-in accessory of the oscilloscope and can not provide any indications unless attached to the oscilloscope, reference must be made to the oscilloscope manual for complete operating instructions. The following instructions pertain to a preamplifier as it would normally be operated when plugged into the oscilloscope.

Note

When the AC-DC-ACX10GAIN control is at either the AC or DC position (marked in black), read the black scale of the VOLTS/CM switch. When the ACX10 GAIN position (marked in blue), is selected, the blue scale of the VOLTS/CM switch is read.

4-9. PEAK-TO-PEAK VOLTAGE MEASUREMENT, NO ATTENUATION PROBE USED. Measure unknown peak-to-peak voltages as follows:

a. Set AC-DC-ACX10 GAIN control to desired position.

b. Rotate VARIABLE control to CALIBRATED position.

c. Connect voltage to be measured to INPUT connector.

CAUTION

Maximum allowable combined dc and peak ac input voltage shall not exceed 600 volts or damage to the preamplifier may result.

d. Rotate VOLTS/CM switch for convenient display on oscilloscope.

e. Rotate VERTICAL POSITION control so waveform displayed is between, or on, two major divisions.

f. Multiply the number of major divisions of vertical deflection by the setting of the VOLTS/CM switch. The product represents the peak-to-peak voltage amplitude.

Control	Purpose or Use
VOLTS/CM rotary switch (black knob)	Provides fixed, calibrated vertical deflection factors, when the VARIABLE control is set at the CALIBRATED position.
VARIABLE VOLTS/CM control (red knob)	Provides continuously variable vertical deflection factors between those selected by the position of the VOLTS/CM switch.
AC-DC-ACX10 GAIN rotary switch	Three positions selector to select either AC or DC input coupling, or ACX10 GAIN position which provides a fixed gain of ten for additional sensitivity.
VERTICAL POSITION control	Positions trace vertically on oscilloscope.
INPUT connector	Provides connection for probe or cable for accepting waveforms to be viewed on oscilloscope.

Figure 4-1. Operating Controls

4-10. PEAK-TO-PEAK VOLTAGE MEASUREMENT, X10 ATTENUATION PROBE USED. Proceed as follows:

a. Set AC-DC-ACX10 GAIN control to desired position.

b. Repeat steps b through e of paragraph 4-9.

c. Multiply the number of major divisions of vertical deflection by the setting of the VOLTS/CM switch. (This product represents the voltage at the INPUT connector.) Multiply the first product by ten to obtain the peak-to-peak voltage amplitude as displayed.

Note

If it is not desired to display the dc component of a waveform, select either AC or ACX10 GAIN.

SECTION V

PERIODIC INSPECTION, MAINTENANCE, AND LUBRICATION

5-1. GENERAL.

5-2. This section contains instructions concerning periodic inspection and maintenance of the preamplifier.

5-3. PERIODIC INSPECTION. Figure 5-1 outlines the inspection procedure for the preamplifier.

5-4. MAINTENANCE. Maintenance of the preamplifier is limited to correcting the defects or failures noted during periodic inspections or use. If any defective components have to be replaced, the calibration procedures outlined in Section VII shall be accomplished following repair.

CAUTION

Repairs requiring soldering on the ceramic terminal boards require use of a heat not to exceed that supplied by a 75 watt iron, or damage to the ceramic terminal boards may result.

5-5. LUBRICATION. The preamplifier requires no lubrication.

Component	Time Period	Inspection
Front panel controls and connectors.	3 months	Check for ease of operation, security, and evidence of damage.
Chassis parts, wires, and electrical connector.	3 months	Check for mounting, security, corrosion, overheating, bent or burned pins as applicable.
Front panel markings.	3 months	Check for cleanliness and clarity.

Figure 5-1. Periodic Inspection Schedule

SECTION VI

TROUBLESHOOTING

6-1. GENERAL.

6-2. The troubleshooting chart, figure 6-1, is provided for quick reference by maintenance personnel. The chart is to be used in conjunction with the schematic diagram, figure 1-3, to isolate malfunctions within the preamplifier.

6-3. Troubleshooting procedures should be performed with the preamplifier connected to the oscilloscope. Access to components can be gained by removing the left side cover and bottom plate of the oscilloscope. It will, however, be necessary to remove the preamplifier to change tubes or circuit components.

CAUTION

Tubes V6242 and V6342 are selected to have high transconductance. If it is necessary to replace either or both of these tubes, select replacement tubes having the highest transconductance (Gm) reading on a transconductance type tube checker. Another method may be by substituting tubes (6 to 8) into the preamplifier until a combination is found which provides the greatest vertical deflection on the crt.

Trouble	Probable Cause	Remedy
Loss of trace on oscilloscope in all positions of AC-DC-ACX10 GAIN control.	Improper vertical positioning voltages.	1. Check and replace as necessary, tubes V6242, V6342, V6732 and V6632. 2. Check associated circuit parts. 3. Adjust Vert Pos. Range potentiometer R6572 as described in paragraph 7-7. 4. Adjust VARIABLE ATTEN. BAL. potentiometer R6812 as described in paragraph 4-3. 5. Check for open tube filament. (All tubes will be extinguished as they are series connected.)
Loss of trace on oscilloscope in ACX10 GAIN position only.	Unbalance (dc) in ACX10 GAIN cathode follower circuit.	1. Check tube V6132 and replace if necessary. 2. Adjust the X10 VARIABLE ATTEN. BAL. potentiometer R6242 as described in paragraph 4-3.
Unable to position trace on oscilloscope with VERTICAL POSITION control. (Trace can be moved with Vert Pos. Range potentiometer.)	VERTICAL POSITION control defective.	Check for open in potentiometer R6522 or broken connector.
Unable to move trace with either VERTICAL POSITION or Vert. Pos. Range controls.	Fault in circuit following phase inverter stage, (tubes V6242 and V6342).	1. Check for open HF peaking potentiometer R6692. 2. Check for a short between correspondingly opposite sides of the phase inverter stage.
No vertical waveform display, trace is present.	First or second amplifier V5942, V6042	1. Check and replace as necessary tubes V5942, V6042. 2. Check associated circuit parts. 3. Check contacts of switch S5002. 4. Check contacts of VOLTS/CM switch S5052.
Insufficient vertical gain in ACX10 GAIN position.	Calibration required.	1. Adjust Cathode Current Adj potentiometer R5922 as described in paragraph 7-8. 2. Adjust X10 GAIN ADJUST potentiometer R6052 as described in paragraph 4-4.
Insufficient vertical gain in AC-DC- and ACX10 GAIN position.	Phase inverter stage.	Replace tubes V6242 and V6342 with high transconductance tubes.
Low-frequency attenuation waveform distortion. (See figure 6-2a.)	Defective cathode or screen by-pass capacitors, or coupling capacitors.	1. Adjust the LF adj potentiometer R6182 as described in paragraph 7-13. 2. Replace cathode, screen-by pass and coupling capacitors until defect is located.
Low frequency over compensation waveform distortion	Excessive low frequency boost in stages V5942 and V6042.	Check and replace, as necessary, capacitors C6002A and C6002B.
	Note Low frequency attenuation and over compensation can also be caused by an improperly adjusted probe. Refer to the oscilloscope manual for adjustment procedures.	
Insufficient high frequency peaking. (See figure 6-3a.)	Insufficient tube transconductance.	1. Check tube transconductance and replace as necessary. 2. Check for short or partial short in peaking coils L5912, L5942, L6012, L6112, L6302, L6292A, L6312, L6292B, L6632, L6732, L6672, and L6772. 3. Check condition of capacitors C6672 and C6772.
High frequency overshoot distortion. (See figure 6-3b.)	Excessive high frequency peaking.	Adjust the HF peaking potentiometer R6692, as described in paragraph 7-14.

Figure 6-1. Troubleshooting Chart

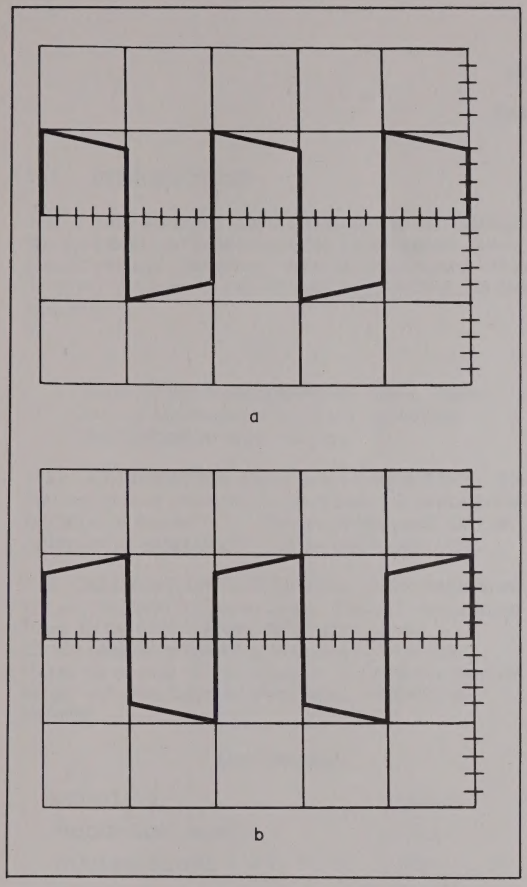

Figure 6-2. Low Frequency Waveform Distortion

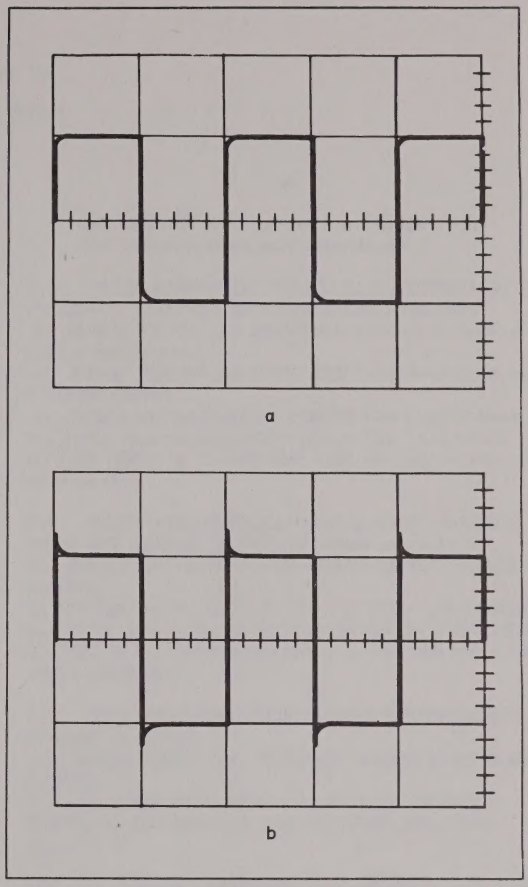

Figure 6-3. High Frequency Waveform Distortion

SECTION VII

CALIBRATION

7-1. INTRODUCTION.

7-2. This section contains procedures for calibrating the preamplifier following parts replacement, prolonged storage, shipment, four hundred hours of use, or every six months, whichever occurs first, to insure accuracy.

Note

Refer to the Troubleshooting Chart, figure 6-1, if troubles are encountered during the calibration procedures.

7-3. CALIBRATION EQUIPMENT REQUIRED. The test equipment required to calibrate the preamplifier is listed in figure 7-1. The test equipment may be replaced or supplemented by an equivalent type.

7-4. CALIBRATION PROCEDURE. Prior to performing any calibration procedures, connect the preamplifier to the oscilloscope by means of the EP-53 plug-in extension, and apply power for a warm-up period of ten minutes. Preset the oscilloscope and preamplifier front panel controls as follows:

Oscilloscope

STABILITY	PRESET
TRIGGERING MODE	AUTO
TRIGGER SLOPE	+ INT
TIME/CM	1 MILLISEC
5X MAGNIFIER	OFF
MULTIPLIER	1
HORIZONTAL DISPLAY	A
AMPLITUDE CALIBRATOR	. 2 VOLTS
HORIZONTAL POSITION	centered
POWER ON	ON

Preamplifier

AC-DC ACX10GAIN	AC
VOLTS/CM (black)	. 05
VARIABLE (red)	CALIBRATED

Perform the calibration procedures in the order that follows.

Note

All controls shall be returned to their initial settings after each adjustment.

7-5. MAIN AMPLIFIER VARIABLE ATTENUATOR BALANCE ADJUSTMENT. Proceed as follows:
a. Rotate VERTICAL POSITION control to vertically center sweep trace.
b. Adjust FOCUS and INTENSITY controls for a well focused display.
c. Rotate the VARIABLE VOLTS/CM control back and forth, and at same time adjust the VARIABLE ATTEN. BAL. potentiometer until the trace remains stationary.

7-6. PREAMPLIFIER VARIABLE ATTENUATOR BALANCE ADJUSTMENT. Proceed as follows:
a. Set AC-DC-ACX10GAIN control at ACX10GAIN position.
b. Rotate the VARIABLE VOLTS/CM control back and forth, and at the same time adjust the VARIABLE ATTEN. BAL. X10 potentiometer until the trace remains stationary.

7-7. VERTICAL POSITION RANGE ADJUSTMENT. Proceed as follows:
a. Rotate VERTICAL POSITION control to its mid-position.
b. Adjust the Vert. Pos. Range potentiometer R6572, so the trace is centered vertically. (See figure 7-4.)

7-8. CATHODE CURRENT ADJUSTMENT. Proceed as follows:
a. Set AC-DC-ACX10GAIN control at ACX10GAIN position.
b. Connect the AN/PSM-6B Multimeter across resistor R6072 (see figure 7-2) and adjust the Cathode Current Adj potentiometer R5922 for a voltage reading of 55 volts (figure 7-4).

7-9. MAIN AMPLIFIER GAIN ADJUSTMENT. Proceed as follows:
a. Connect a cable between the CAL. OUT and INPUT connectors.
b. Adjust the top front panel GAIN ADJUST for exactly four centimeters of vertical deflection.

Note

Be sure the controls are set to their initial positions.

Nomenclature	Part Number or Model	Application	Range	Accuracy
Oscilloscope	LA-265* (Lavoie)	Preamplifier plugs in.		
Square-wave Generator	Type 105 (Tektronix)	Frequency compensation.	Output frequencies of 25 cps to one mc; rise time no longer than 13 millimicroseconds.	±3%
Square-wave Generator	Type 107 (Tektronix)	High Frequency peaking.	Output frequencies of 400 KC to 1 mc; rise time no longer than 3 millimicroseconds.	
Constant amplitude Signal Generator	Type 190A (Tektronix)	Frequency response measurements.	Output frequencies 350 KC to 30 mc.	
Terminating Resistor	B-52-R (Tektronix)	High frequency peaking.		
Multimeter	AN/PSM-6B	Voltage adjustments.		
Coaxial Cable	P52 (Tektronix)	Input capacitance adjustment.		
"L" Pad	B52-L5 (Tektronix)	Input capacitance adjustment.		
Input Capacitance Standardizer	Type CS-20 (Tektronix)	Input capacitance adjustment.		
"L" Pad	B52-L10 (Tektronix)	Low frequency compensation.		
Plug-in Extension	EP-53 (Tektronix)	Extends preamp from oscilloscope for adjustment accessibility.	3-1/4" long.	

*Oscilloscope LA-275, LA-275C or LA-285 may also be used. When the LA-275 or LA-275C is employed, the maximum range specified in paragraph 7-17, steps e. and c. (MAIN AMPLIFIER BANDPASS TEST) is extended to 40 megacycles while that in paragraph 7-18 step b. (PREAMPLIFIER BANDPASS TEST) is extended to 27 MC.

Figure 7-1. Recommended Calibration and Final Testing Test Equipment

7-10. PREAMPLIFIER GAIN ADJUSTMENT. Proceed as follows:

a. Set the AMPLITUDE CALIBRATOR control to 20 MILLIVOLTS.

b. Connect a cable between the CAL. OUT and INPUT connectors.

c. Set AC-DC-ACX10GAIN control at ACX10GAIN position.

d. Set VOLTS/CM (black) control at .005.

e. Adjust the front panel ACX10GAIN ADJUST potentiometer R6052 for exactly four centimeters of vertical deflection.

7-11. INPUT CAPACITANCE ADJUSTMENT. Proceed as follows:

a. Connect coaxial cable P52 to output connector of Type 105 square wave generator.

b. Connect the B52-L5 "L" pad between other end of P52 cable and the Type CS-20 input capacitance standardizer.

c. Connect other end of Type CS-20 input capacitance standardizer to preamplifier INPUT connector.

d. Set the Type 105 square wave generator FREQUENCY control for an output of approximately 1000 cycles.

e. Set the Type 105 OUTPUT AMPLITUDE control for a vertical deflection of approximately 3.3 centimeters.

f. Adjust capacitor C5732 (see figure 7-2) for a flat top on the displayed square wave.

7-12. ATTENUATOR INPUT CAPACITANCE STANDARDIZATION AND FREQUENCY COMPENSATION. Proceed as follows:

a. Repeat steps a. through e. of paragraph 7-11.

b. Set VOLTS/CM switch at .1 position, and adjust capacitor C5072 for a flat top, and capacitor C5102 (see figure 7-3) for a square corner on displayed signal.

c. Set VOLTS/CM switch at .2 position, and adjust capacitor C5142 for a flat top, and capacitor C5162 for a square corner on displayed signal.

d. Remove the Type B52-L5 "L" pad, and adjust the Type 105 square wave generator RANGE and FREQUENCY controls to display five or six cycles on the oscilloscope.

e. Adjust the associated capacitors (see figures 7-3 and 7-4) using the procedure described in steps b. and c., for the following positions of the VOLTS/CM control:

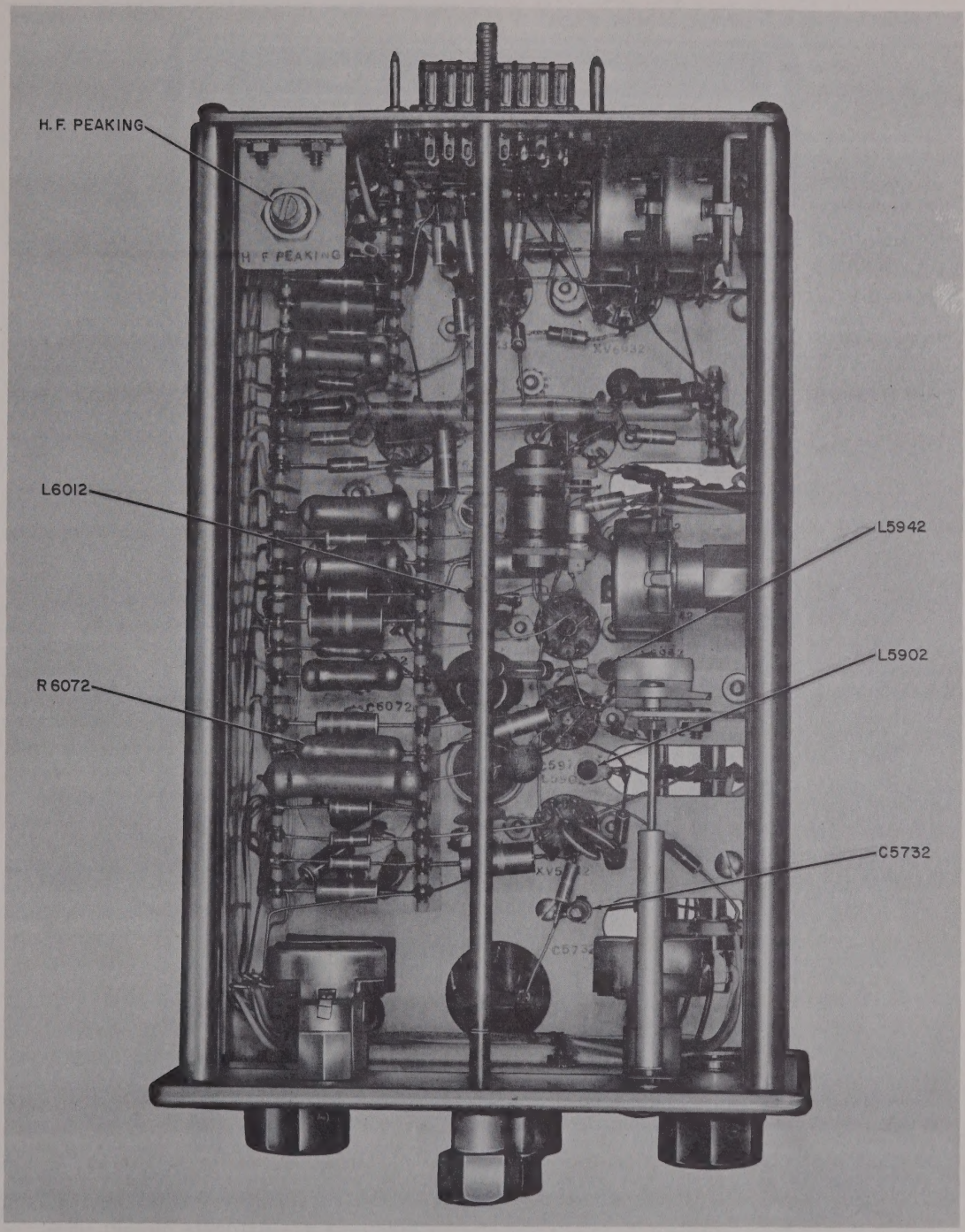

Figure 7-2. Plug-in Preamplifier LA-265-L, Bottom View

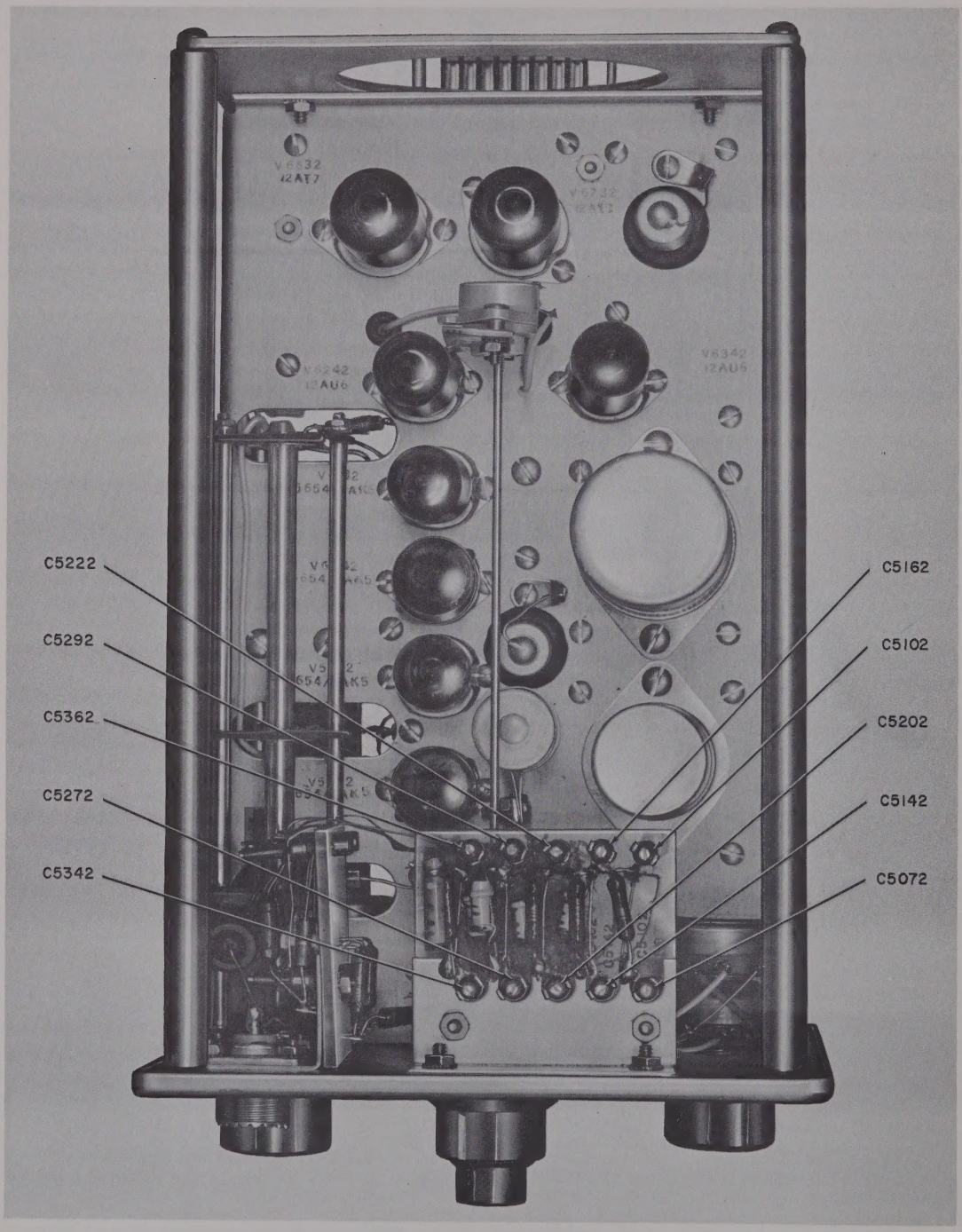

Figure 7-3. Plug-in Preamplifier LA-265-L, Top View

VOLTS/CM Setting	Flat Top	Square Corner
0.5	C5202	C5222
1	C5272	C5292
2	C5342	C5362
5	C5412	C5432
10	C5502	C5522
20	C5602	C5622

Note

As the VOLTS/CM control is positioned to each position, readjust the Type 105 OUTPUT AMPLITUDE control for approximately three divisions vertical deflection.

7-13. PREAMPLIFIER LOW-FREQUENCY COMPENSATION ADJUSTMENT. Proceed as follows:

a. Set the TIME/CM control at 50 MILLISEC position.

b. Set AC-DC-ACX10GAIN control at ACX10GAIN position and the VOLTS/CM (black) control at .005 position.

c. Repeat steps a through c of paragraph 7-11 utilizing "L" pad B52-L10 in place of the B52-L5.

d. Set the Type 105 square wave generator frequency control for an output frequency of 50 cycles.

e. Set the Type 105 OUTPUT control for approximately three centimeters vertical deflection.

f. Adjust the Low-Freq Adj. potentiometer, R6182, (see figure 7-4) so the horizontal portion of the displayed square wave has the same slant as the waveform displayed when the AC-DC-ACX10GAIN control is positioned to the AC position.

Note

Maintain three divisions vertical deflection with the Type 105 output AMPLITUDE control when switching the AC-DC-ACX10GAIN control.

7-14. MAIN AMPLIFIER HIGH FREQUENCY COMPENSATION. Proceed as follows:

a. Change the oscilloscope and preamplifier initial control settings as follows:

Oscilloscope

TRIGGER SLOPE	-INT
TIME/CM	.1 MICROSEC

Preamplifier

AC-DC-ACX10GAIN	DC
VOLTS/CM	.05

b. Lay oscilloscope on its side with bottom cover removed.

c. Connect the P52 coaxial cable to the output connector on the Type 107 signal generator.

d. Connect the B52-R terminating resistor to other end of P52 coaxial cable, and then to the preamplifier INPUT connector.

e. Set the Type 107 APPROXIMATE FREQUENCY control for an output of approximately 500 KC.

f. Set the APPROXIMATE AMPLITUDE control for a vertical deflection of three centimeters.

f. Adjust the H. F. Peaking potentiometer R6692 (see figure 7-2) for a square wave display having no overshoot.

7-15. PREAMPLIFIER HIGH FREQUENCY COMPENSATION. Proceed as follows:

a. Set the oscilloscope controls and position oscilloscope as described in paragraph 7-14 a and b.

b. Set the preamplifier controls as follows:

AC-DC-ACX10 GAIN	ACX10GAIN
VOLTS/CM	.005
VARIABLE	CALIBRATED

c. Connect the Type B52-L10 "L" pad to the Type 107 square-wave generator OUTPUT connector, connect the Type B52 coaxial cable from the "L" pad to the preamplifier INPUT connector.

d. Adjust coils L5902, L5942, and L6012 (see figure 7-2) for a square cornered display, having optimum risetime.

7-16. FINAL TESTING. Upon completing the calibration procedures, perform the final test procedure that follows to ensure serviceability.

7-17. MAIN AMPLIFIER BANDPASS TEST. Proceed as follows:

a. Set controls as indicated:

1.	HORIZONTAL DISPLAY	'A'
2.	TRIGGER MODE	AC
3.	TIME/CM	50 MILLISEC
4.	STABILITY	Fully clockwise
5.	TRIGGER SLOPE	-INT
6.	AC-DC-ACX10GAIN	DC
7.	VOLTS/CM	.05

b. Connect constant amplitude signal generator to INPUT connector. Set frequency to 350 KC and amplitude to obtain 3 centimeters of vertical deflection.

c. Slowly increase frequency of signal generator until 30 MC is reached. The vertical deflection amplitude shall not be more than 3 db down (2.1 centimeter deflection) over this range.

d. Remove Test Oscillator, and connect constant Output Signal Generator in its place. Set output frequency at 350 KC, and output amplitude to 100 millivolts.

e. Slowly increase frequency of signal generator until 30 megacycles is reached, noting variations over the frequency range, the variations shall not exceed ±3 db.

7-18. PREAMPLIFIER BANDPASS TEST. Proceed as follows:

a. Set AC-DC-ACX10GAIN switch to ACX10GAIN position. Connect "L" pad between signal generator and input connector.

b. Repeat steps b and c of paragraph 7-17, over a frequency range of 350 KC to 24 megacycles. The vertical display amplitude shall not be more than 3 db down (2.1 centimeter deflection) over this range.

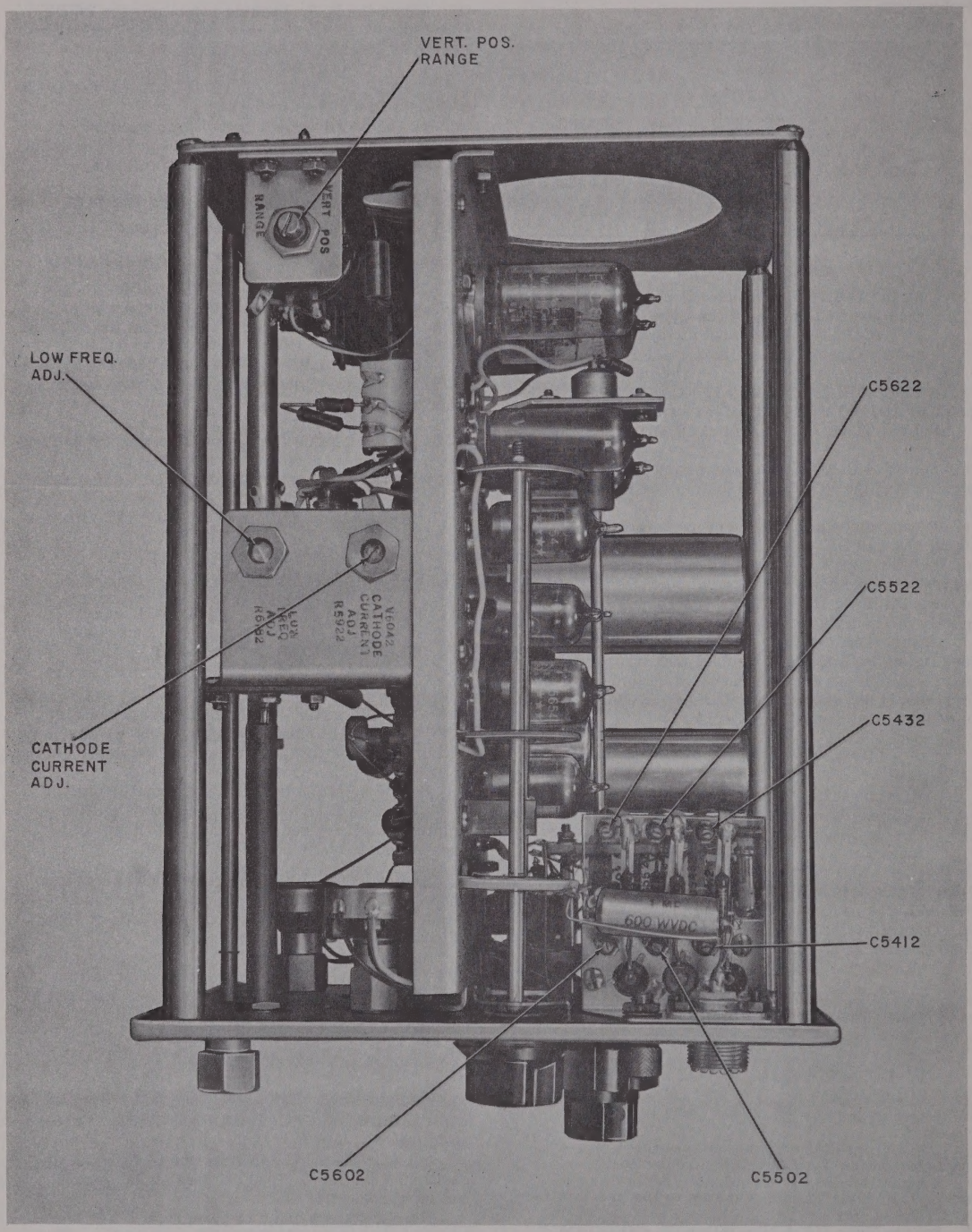

Figure 7-4. Plug-in Preamplifier LA-265-L, Left Side View

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
C-5002	CAPACITOR, fixed, polyester dielectric, .1 mfd, ±10%, 600 Vdcw -55 °C to +85 °C	P31900043	Sprague Electric Co. 148P10496
C-5042	CAPACITOR, fixed, mica 100 pf (MIL-C-5)	P66152101	CM15B101K
C-5072	CAPACITOR, variable, 0.7 - 3.0 mmf, 350 Wvdc	P31830031	Erie Resistor Corporation 535-008
C-5092	CAPACITOR, fixed, ceramic, temp. comp. 10 mmfd, ±1 mmf (MIL-C-20D)	P91300080	CC20CH100F
C-5102	Same as C-5072		
C-5142	Same as C-5072		
C-5152	CAPACITOR, SELECTED, fixed, ceramic, temp. comp. 1.5 mmfd, ± 0.25 mmf (MIL-C-20D)	P91300079	CC20CK1R5C
C-5162	Same as C-5072		
C-5172	Same as C-5152		
C-5202	Same as C-5072		
C-5212	CAPACITOR, SELECTED, fixed ceramic, temp. comp. 3 mmf, ± 0.25 mmf, 500 Vdc(MIL-C-20D)	P91300048	CC20CJ030C
C-5222	Same as C-5072		
C-5272	Same as C-5072		
C-5282	CAPACITOR, fixed, ceramic, temp. comp. 2 mmfd ± .25 mmf(MIL-C-20D)	P91300081	CC20CK020C

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
C-5292	Same as C-5072		
C-5312	CAPACITOR, fixed, ceramic, temp. comp. 47 mmfd, ±10%(MIL-C-20D)	P91300082	CC20UJ470K
C-5342	Same as C-5072		
C-5352	Same as C-5212		
C-5362	Same as C-5072		
C-5382	CAPACITOR, fixed, mica, 100 pf (MIL-C-5)	P66162101	CM15C100K
C-5412	Same as C-5072		
C-5422	Same as C-5212		
C-5432	Same as C-5072		
C-5452	CAPACITOR, fixed, silver mica feed-thru, 250 mmf ±10%, 500 Vdcw	P31530034	Erie Resistor Corporation 370-CB-251K
C-5502	Same as C-5072		
C-5512	Same as C-5212		
C-5522	Same as C-5072		
C-5542	CAPACITOR, fixed, mica, feed-thru 500 mmf ±10%, 500 Vdcw	P31530035	Erie Resistor Corporation 370-CB-501K
C-5602	Same as C-5072		
C-5612	CAPACITOR, SELECTED, fixed, ceramic, temp. comp. 5 mmfd ± .5 mmf (MIL-C-20D)	P91300054	CC20CH050D

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
C-5622	Same as C-5072		
C-5642	CAPACITOR, fixed, silver mica, feed-thru, 750 mmf ±10%, 500 Vdcw	P31530033	Erie Resistor Corporation 370-CB-751K
C-5722	CAPACITOR, fixed, ceramic disc. .005 mfd, 500 Vdcw	P31300096	Erie Resistor Corporation 801000Z5U0502Z
C-5732	Same as C-5072		
C-5802	CAPACITOR, fixed, electrolytic, polarized, 6.25 mfds, 300 Vdcw	P31400067	Cornell-Dublier Electric Corp. BBR 6.25-300
C-5812	Same as C-5722		
C-5822	Same as C-5722		
C-5872	Same as C-5722		
C-5902	Same as C-5802		
C-5972	CAPACITOR, fixed, electrolytic polarized, 500 mfds, 6 volts	P31400080	Cornell-Dublier Electric Corp. BRH10126-1
C-6002	CAPACITOR, fixed, electrolytic polarized, 10 mfds, 20 mfds, and 40 mfds, 475 Vdcw	P31400077	Sprague Electric Co. D34143
C-6062	CAPACITOR, fixed, ceramic disc, .01 mfd, 500 Vdcw	P31300054	Erie Resistor Corporation 811000Z5U0103P
C-6072	CAPACITOR, fixed, electrolytic, polarized, 3X75 mfds, 150 Vdcw	P31400078	Sprague Electric Co. D27019

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
C-6102	Same as C-5722		
C-6112	CAPACITOR, fixed, plastic dielectric, .047 mfd ±10%, 400 Vdc (MIL-C-27287)	P91900003	CTM473VCK
C-6132	Same as C-5722		
C-6192	Same as C-6062		
C-6302	CAPACITOR, fixed, ceramic disc, .001 mfd, 500 Vdcw	P31300040	Erie Resistor Corporation 831000Z5U0102P
C-6332	Same as C-5722		
C-6672	Same as C-6302		
C-6772	Same as C-6302		
C-6832	Same as C-5722		
C-6922	Same as C-6062		
C-6952	Same as C-6062		
L-5902	COIL, Q=85, .5 UH @ 25 Mc ±3%	K50131313	Lavoie K50131313
L-5932	COIL, Q=less than one, .75 UH ±5% @ 25 Mc	K50131395	Lavoie K50131395
L-5942	COIL, Q=45, 1.8 UH @ 7.9 Mc	K50131314	Lavoie K50131314
L-6012	COIL, RF	K50131315	Lavoie K50131315

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
L-6112	COIL, first coil .6 UH, Q=68 @ 25 Mc second coil 1.7 UH Q=40 @ 7.9 Mc inductance ±3%	K50135099	Lavoie K50135099
L-6282	COIL, Q= less than one, L=.13 UH ±10% @ 25 Mc	K50131390	Lavoie K50131390
L-6292	COIL, first coil Q=45, 1.6 UH ±1% @ 7.9 Mc total coil. second coil Q=45, 1.6 UH ± 1% @ 7.9 Mc total coil	K50135112	Lavoie K50135112
L-6302	COIL, Q=75 ±10%, .37 UH ±5% @ 25 Mc	K50131421	Lavoie K50131421
L-6312	Same as L-6302		
L-6633	Same as L-6302		
L-6672	COIL, Q=75 ±15%, .3 UH ±5% @ 25 Mc	K50131422	Lavoie K50131422
L-6732	Same as L-6302		
L-6772	Same as L-6672		
R-5002	RESISTOR, fixed, composition 1/2 W, ±10%, 33 ohms(MIL-R-11)	P62002330	RC20GF330K
R-5042	RESISTOR, fixed, composition 1/2 W, ±5%, 62 ohms (MIL-R-11)	P62001620	RC20GF620J
R-5052	RESISTOR, fixed, composition 1/2 W, ±10%, 47 ohms(MIL-R-11)	P62002470	RC20GF470K
R-5092	RESISTOR, fixed, 1/2 W, ±1%, 499K ohms (MIL-R-10509D)	P96400151	RN70B4993F

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-5112	RESISTOR, fixed, "film type" high stability, 1/2 W, ± 1%, 1 meg ohm (MIL-R-10509D)	P96400138	RN70B1004F
R-5162	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 750K ohms (MIL-R-10509D)	P96400142	RN70B7503F
R-5172	RESISTOR, fixed, "film type" high stability, 1/2 W, ± 1%, 333K ohms 350 volts DCW	P36400333	Dale Products Inc. RN70B3333F (Molded)
R-5222	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 900K ohms 350 Vdcw	P36400334	Dale Products Inc. RN70B9003F (Molded)
R-5242	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 111K ohms 350 Vdcw	P36400332	Dale Products Inc. RN70B1113F (Molded)
R-5292	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 950K ohms 350 Vdcw	P36400335	Dale Products Inc. RN70B9503F (Molded)
R-5312	RESISTOR, fixed, "film type"high stability, 1/2 W, ±1%, 52.6K ohms 350 Vdcw	P36400331	Dale Products Inc. RN70B5262F (Molded)
R-5362	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 976K ohms (MIL-R-10509D)	P96400167	RN70B9763F

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-5372	RESISTOR, fixed, composition 1/2 W, ±10%, 10 ohms(MIL-R-11)	P62002100	RC20GF100K
R-5382	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 25.6K ohms 350 Vdcw	P36400340	Dale Products Inc. RN70B2562F (Molded)
R-5432	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 990K ohms 350 Vdcw	P36400320	Dale Products Inc. RN70B9903F (Molded)
R-5442	RESISTOR, fixed, composition, 1/2 W, ±10%, 100 ohms(MIL-R-11)	P62002101	RC20GF100K
R-5452	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 10.1K ohms 350 Vdcw	P36400329	Dale Products Inc. RN70B1012F (Molded)
R-5462	Same as R-5372		
R-5522	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 995K ohms 350 Vdcw	P36400321	Dale Products Inc. RN70B9953F (Molded)
R-5532	Same as R-5442		
R-5542	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 5.03 ohms 350 Vdcw	P36400328	Dale Products Inc. RN70B5031F (Molded)
R-5552	Same as R-5372		
R-5622	RESISTOR, fixed, carbon, "film type" 1/2 W, ±1%, 997.5K ohms, 350 Vdcw	P36400337	Penn Resistor Corporation FCA15(997.5K ohms) 1%

PARTS LIST
PLUG-IN PREAMPLIFIER
LA-265-L

Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-5632	RESISTOR, fixed, composition, 1/2 W, ±10%, 330 ohms(MIL-R-11)	P62002331	RC20GF331K
R-5642	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 2.5K ohms 350 Vdcw	P36400336	Dale Products Inc. RN70B2501F (Molded)
R-5652	Same as R-5372		
R-5722	RESISTOR, fixed, composition 1/2 W, ±10%, 100K ohms(MIL-R-11)	P62002104	RC20GF104K
R-5732	Same as R-5112		
R-5802	RESISTOR, fixed, composition, 1/2 W, ±10%, 68K ohms(MIL-R-11)	P62002683	RC20GF683K
R-5812	Same as R-5052		
R-5822	Same as R-5052		
R-5832	Same as R-5052		
R-5862	RESISTOR, fixed, composition, 2 W, ±10%, 22K ohms(MIL-R-11)	P62022223	RC42GF223K
R-5872	Same as R-5052		
R-5902	RESISTOR, fixed, composition, 1 W, ±5%, 33K ohms(MIL-R-11)	P62011333	RC32GF333J
R-5912	RESISTOR, fixed, composition, 1/2W, ±10%, 1 meg ohm(MIL-R-11)	P62002105	RC20GF105K
R-5922	RESISTOR, variable, wire wound, 2 W, ±10%, 10K ohms	P36770048	Clarostat Mfg. Co., Inc. Series 43-10K ohms(CM28245)

PARTS LIST
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Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-5932	RESISTOR, fixed, wire wound, 5 W, ±5%, 10K ohms	P36500214	Ward Leonard Electric Co. 5X1000(AXIOHM)
R-5942	RESISTOR, fixed, composition, 1/2 W, ±5%, 680 ohms(MIL-R-11)	P62001681	RC20GF681J
R-5972	RESISTOR, fixed, wire wound, 8 W, ±5%, 12K ohms	P36500208	Ward Leonard Electric Co. 8X12000(AXIOHM)
R-6002	RESISTOR, fixed, composition, 2 W, ±10%, 12K ohms(MIL-R-11)	P62022123	RC42GF123K
R-6012	RESISTOR, fixed, composition, 1/2 W, ±5%, 1K ohm(MIL-R-11)	P62001102	RC20GF102J
R-6032	Same as R-5372		
R-6042	Same as R-5632		
R-6052	RESISTOR, variable, composition, 1/2 W, ±10%, 250 ohms(MIL-R-94B)	P96700067	RV6NAYSD251A
R-6062	RESISTOR, fixed, composition 1 W, ±10%, 2.7 ohms(MIL-R-11)	P620122R7	RC32GF2R7K
R-6072	RESISTOR, fixed, wire wound, 5 W, ±1%, 6K ohms	P36400362	Ward Leonard Electric Co. 6000R ±1% (AXIOHM)
R-6082	Same as R-5382		
R-6102	Same as R-5052		
R-6132	Same as R-5862		

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Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-6142	Same as R-5052		
R-6172	RESISTOR, fixed, composition, 1/ 2 W, ±10%, 330K ohms (MIL-R-11)	P62002334	RC20GF334K
R-6182	RESISTOR, variable, composition, 2 W, ±20%, 2 meg ohms(MIL-R-94B)	P96700057	RV4NAYSD205B
R-6192	RESISTOR, fixed, composition, 1/2 W, ±10%, 3300 ohms (MIL-R-11)	P62002332	RC20GF332K
R-6202	RESISTOR, fixed, composition, 1/2 W, ±10%, 3.9 meg ohms(MIL-R-11)	P62002395	RC20GF395K
R-6222	RESISTOR, fixed, composition, 1/2 W, ±10%, 470K ohms(MIL-R-11)	P62002474	RC20GF474K
R-6242	RESISTOR, variable, composition, 2 W, ±20%, 100K ohms(MIL-R-94B)	P96700055	RV4NAYSD104B
R-6282	RESISTOR, fixed, wire wound, power type (MIL-R-26B)	P65572202	RW57G202
R-6292	RESISTOR, fixed, "film type" high stability, 1/2 W, ±1%, 499 ohms (MIL-R-10509D)	P96400162	RN70B4990F
R-6302	Same as R-6292		
R-6352	RESISTOR, variable, composition, 1/2 W, ± 10%, 360 ohms	P36700262	Allen Bradley Co. GA2G040S361UZ
R-6362	RESISTOR, fixed, composition, 1 W, ±10%, 1500 ohms(MIL-R-11)	P62012152	RC32GF152K
R-6372	Same as R-6362		

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Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-6382	RESISTOR, fixed, wire wound, 5 W, ±5%, 4500 ohms	P36500207	Ward Leonard Electric Co. 5X4500(AXIOHM)
R-6392	RESISTOR, variable, wire wound 2 W, ±10%, 5000 ohms	P36770050	Clarostat Mfg. Co. Inc. Series 43-5K ohms (CMZ8255)
R-6422	RESISTOR, fixed, composition, 2 W, ±10%, 5600 ohms(MIL-R-11)	P62022562	RC42GF562K
R-6432	RESISTOR, fixed, composition, 1/2 W, ±10%, 10K ohms(MIL-R-11)	P62002103	RC20GF103K
R-6512	Same as R-5722		
R-6522	RESISTOR, variable, composition dual, 2W, ±20%, 100K ohms	P36700253	Clarostat Mfg. Co. Inc. Series 53M(Dual) 100K ±20%
R-6532	Same as R-5722		
R-6562	RESISTOR, fixed, composition, 1/2 W, ±10%, 82K ohms(MIL-R-11)	P62002823	RC20GF823K
R-6572	RESISTOR, variable, composition, dual, 2 W, ±20%, 100K ohms	P36700252	Clarostat Mfg. Co. Inc. Series 53M(Dual) 100K ±20%
R-6582	Same as R-6562		
R-6612	Same as R-5052		
R-6622	Same as R-6332		
R-6632	RESISTOR, fixed, composition 1 W, ±5%, 8200 ohms(MIL-R-11)	P62011822	RC32GF822J

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Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
R-6662	RESISTOR, fixed, composition, 2 W, ±10%, 3900 ohms (MIL-R-11)	P62022392	RC42GF322K
R-6672	Same as R-6632		
R-6682	Same as R-6632		
R-6692	RESISTOR, variable, composition, 2 W, ± 10%, 2500 ohms(MIL-R-94B)	P96700040	RV4NAYSD252A
R-6712	Same as R-5052		
R-6722	Same as R-6332		
R-6732	Same as R-6632		
R-6772	Same as R-6632		
R-6782	Same as R-6632		
R-6812	RESISTOR, variable, composition, 2 W, ±20%, 100 ohms(MIL-R-94B)	P96700052	RV4NAYSB101B
R-6822	RESISTOR, fixed, composition 1 W, ±10%, 12 ohms(MIL-R-11)	P62012120	RC32GF120K
R-6832	RESISTOR, fixed, composition, 1 W, ±10%, 4.7 ohms(MIL-R-11)	P620124R7	RC32GF4R7K
R-6862	RESISTOR, fixed, wire wound, power type, 5 W, 3K ohms (MIL-R-26B)	P65572302	RW57G302
R-6922	Same as R-5052		
V-5832	TUBE, electron, pentode,	P38700137	RCA 6AK5

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Circuit Reference	Description	Lavoie Part No.	Mfr's Part No.
V-5942	Same as V-5832		
V-5972	DIODE, crystal, germanium 60 Wvdc (MIL-E-1D)	P92600010	1N69A
V-6042	Same as V-5832		
V-6132	Same as V-5832		
V-6242	TUBE, electron, pentode	P38700131	RCA 12AU6
V-6342	Same as V-6242		
V-6632	TUBE, electron, twin triode,	P38700135	Telefunken ECC81/12AT7
V-6732	Same as V-6632		
SW-5002	SWITCH, rotary, 3 sections, 4 poles, 3 positions	P38170152	Oak Mfg. Co. Type F
SW-5052	SWITCH, rotary, concentric shafts 2 sections, 5 poles, 9 positions	P38170153	Oak Mfg. Co. Type F
XV-5832	SOCKET, tube, 7 pin miniature	P37600078	Hugh H. Eby Co. 9735-31
XV-5942	SOCKET, tube, 7 pin minature	P37600075	Hugh H. Eby Co. 2150 Special
XV-6042	SOCKET, tube, 7 contacts miniature (MIL-S-12883A)	P97600003	TS102P01
XV-6132	Same as XV-5942		
XV-6242	Same as XV-5942		
XV-6342	Same as XV-5942		
XV-6632	SOCKET, tube, 9 pin miniature	P37600079	Hugh H. Eby Co. 9739-22
XV-6732	Same as XV-6632		